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Introduction

After being settled, human being developed road networks to provide connection between settlements. Roads are developed with the automobile industry at the beginning of the 20th century. New roads may induce development in previously undeveloped areas, sometimes significantly affecting sensitive environments and the lifestyles of indigenous people. Motor vehicle use has increased rapidly with the result that transportation is now a major source of environmental problems. Human activities within a landscape often result in loss of land cover types, fragmentation of habitats, remaining land cover into smaller and more isolated, disturbing wildlife movements and plants. Transportation decisions affect land use patterns and resulting in economic, social and environmental impacts. Roads often bring significant economic and social benefits, but they can also have substantial negative impacts on communities and the natural environment. Each major highway or other transportation project impacts the environment in different ways. Direct impacts on land used for transportation facilities, and indirect impacts caused by changes to land use development patterns so they can be evaluated from various perspectives, such as a particular geographic area or time period (Mansuroglu, 1999).

In Turkey first years of the Republic, railway construction which was accepted as the most contemporary technology in that era, was important for the transportation sector and railways had priority rather than highways. In 1923 there was 18 350 km road network. However, it was understood that just railway wasn't sufficient and highway was needed for the transportation system, so Paved Ways and Bridges Presidency under the body of the Ministry of Public Works was founded in 1929, and highway construction works gained momentum with the road law in force. With the requirement of directing all this activities by a dynamic organization with contemporary methods, General Directorate of Highways (GDH) was founded on March 1st, 1950. Thus with the new highways policy, divisions under the body of GDH were formed throughout the country (GDH, 2015). Nowadays the total length of highway which is under control of GDH is 131818 km. (Table 1).

Table 1. Road lengths In Turkey (km) (TUIK, 2016)

Year	General Total	Total		State highways		Provincial roads		Motor-ways
		Divided road	Other	Divided road	Other	Divided road	Other	
1984	118378	1437	57752	1291	29691	69	28061	77
1994	121966	3502	57481	2149	29240	202	28241	1151
2004	126952	8972	54504	6735	24711	575	29793	1662
2014	131818	22460	43449	18944	12336	1361	31113	2155

There are some negative environmental impacts of highways increasing day by day. Therefore, there is a growing awareness for road projects in the world. Some of these impacts of road projects are damage to sensitive ecosystems (Forman and Hersberger 1996; Spellerberg and Morrison 1998), cause noise, loss of productive agricultural lands (Mansuroglu, 1999; Swanson, 2001), resettlement of large numbers of people, permanent disruption of local economic activities, demographic change, accelerated urbanization, and introduction of disease. To minimize these effects, an approach that takes the natural assets of highway route and land use developments into account at planning stage is very important.

Study Areas and Method

The research areas are Antalya, Izmir and Tekirdag highways in rural landscapes. At the begining, an area of 500 meters at the both sides of the highways were considered as research area when studying the impacts on rural landscapes.

Antalya is the fifth most populous city in Turkey located on Anatolia's flourishing southwest coast bordered by the Taurus Mountains. It is the largest Turkish city on the Mediterranean coast with over two million people in its metropolitan area. Antalya is Turkey's biggest international sea resort, located on the Turkish Riviera. Large-scale development and governmental funding has promoted tourism. A record 12.5 million tourists passed through the city in 2014. Antalya-Alanya highway is passing through different land-uses. Highway connects a lot of touristic settlements between Antalya and Alanya. Because of intensive tourism and agriculture activities, highways make contribution to local economy. Antalya-Alanya highway's traffic lane number is 2x2 and lanes are 3,5 m, banquets are 2-2.5 m, refuges are 4m width. Project speed is 90 km/h and divided road is asphalted (GDH, 2015).

Izmir is in the position of being the fourth tourist attraction destination, the third biggest city allowing immigrants and is therefore the most crowded city, and also one of the biggest seaports in the Agean Sea. Having the biggest port

on volume of business and exportation in Turkey has a big effect on Izmir maintaining its importance without losing any significance. The transportation opportunities in Izmir that is surrounded by important agricultural areas, natural and environmental resources of Turkey and Aegean Region, contribute to the development of the city (Bal, 2008).

Izmir City Region is formed by mountains that are parallel to each other in the eastwest axis, running perpendicular to the sea. According to the Turkish Statistical Institute's year 2000 population census, the population of the Izmir province is 3 million 370 thousand 866 (IzGM 2006). The province, Izmir provides a variety in its transportation network, as well as high capacity modes and good quality integration facilities. These superiorities are a result of its general geographical properties, its regional and international potential, and its location opportunities. Especially in the 18th and 19th centuries, the agricultural products, which were grown in the abundant basins of the Aegean Region, were gathered in Izmir and exported to Europe. In addition, after the Republic of Turkey was established in 1923, with new developments, Izmir has become a metropolis. New economic sectors have settled in the region; settlements have sprawled and therefore infrastructure systems have been developed. The highways in Izmir City Region started to be built in the 1980s. The highway s in the Izmir City Region are Izmir-Aydın highway, Izmir-Cesme highway, and Izmir circumferential expressways. Izmir-Canakkale motorway is under construction. Another highway, which will connect Izmir to Bursa passing Manisa, has been planned along Kemalpasa-Turgutlu route in the east of Izmir (Nal, 2008).

The length of roads in the Aegean Region is 5,510 km in total consisting of 368 km highway, 2,524 km state highway, 2,618 km provincial road. Thrace Region, where Trans European Motorway (TEM) is located and has a strategic importance connecting Turkey to Europe, is in the northwest corner of Turkey, and is located on Europe continent The 40 km part of TEM is located within the borders of Tekirdag, and has a total length of roads 639 km including state highways and provincial roads (GDH, 2015).

The research was conducted between 2014 and 2015 in three steps by using landscape analysis-assessment-synthesis approach (Mc Harg, 1969). At the first step, natural and cultural structure of the area were analyzed. At the second step current land uses were identified. Finally impacts of Antalya, Izmir and Tekirdag highways on rural landscapes were examined as direct and indirect impacts.

Results and Discussion

Highways, which are passing through rural landscapes, not only damage the natural features but also cause various ecological problems. There are some negative environmental impacts of highways that increase day by day. Because of that there is a growing awareness worldwide for impacts of road projects. Some of these impacts of road projects are damage to sensitive ecosystems, cause noise, loss of productive agricultural lands, resettlement of large numbers of people, permanent disruption of local economic activities, demographic change, accelerated urbanization, and introduction of disease. To minimize these effects, an approach that takes the natural assets of highway route and land use developments into account at planning stage is very essential. On planning stage in Turkey, road builders do not consider natural and cultural assets, thus environmental problems occurs. Economic solutions mostly prevail natural solutions. The landscape planning for highway is limited to the plantation works which are done after construction of the highway. Determination of the impacts of the highway on the natural resources is of importance for the sustainability of the rural landscapes. For this reason, direct and indirect impacts of the highway were considered and problems concerning the route choice and the uses were investigated in this study.

Direct Impacts

Direct impacts are caused by the road itself that is to say, by road building processes such as land consumption, removal of vegetation, and severance of agricultural areas. Direct impacts are generally easier to inventory, assessment, and control than indirect impacts, since the cause-effect relationship is usually obvious. The most immediate and obvious effect of highways on soil is the elimination of the productive capacity of the soil covered by highway and division of rural areas (Rodriguez-Flores and Rodriguez Castellon 1982, Angold 1997). Mostly, the best sites for highway development (flat and stable) also tend to be ideal for agriculture. For example Antalya-Alanya highway passes over 1st and 2nd class alluvial soils. In Antalya-Alanya highway 0-500 meters far from each sides of highway where the impacts are heavy, there are 475 hectares 1st class, 2008 hectares 2nd class and 657 hectares 3rd class soil types of agricultural soils (Mansuroglu and Kinikli 2015a). Izmir-Aydin and Izmir-Cesme highways also cross over 1st, 2nd, and 3rd class soil types of agriculture (Yilmaz, 1999). These fertile agricultural areas extinct due to the expanding and increas in number of highways. Tekirdag has a significant potential of agriculture; however, as a result of rapid urbanisation and industrialisation, agricultural soil is under threat. For the construction and use of the highway in all three cities within the scope of this study, rich soil was damaged and caused the loss of the top soil (Mansuroglu and Kinikli 2015a).

One of the direct impacts is air pollution caused by the emission of pollutants by vehicles. Pollution of motor vehicles play a significant role in a serious problem. The main products of the combustion of motor fuels are carbon dioxide and water, but inefficiencies and high temperatures inherent in engine operation encourage the production of many other pollutants of varying effect. The major pollutants are Nitrogen oxides (NOX), Hydrocarbons (HC), Carbon monoxide (CO), Sulfur dioxide (SO_2,), lead (Pb), aldehydes and other particulates. Although no measurement was done in the research for the heavy metal accumulation in near vicinity of the highway, it can be said that with a daily vehicle intensity of 36.000 (Antalya-Alanya highway), there has been heavy metal accumulation in the rural areas (Mansuroglu et al., 2013).

According to 2014 statistics carried out by the GDH, the daily intensity of vehicle traffic at Izmir periphery road is 54,440 at its Gaziemir-Balcova part, whereas this number becomes 66,668 at its Bornova – Karsıyaka part. In addition, the intensity of traffic volume at TEM within Tekirdag borders is stated to be 13,957 in total. While the traffic volume increases towards Istanbul, it decreases towards Edirne (GDH, 2015).

There has been heavy metal accumulation in the rural areas, too. As the agricultural fields, orchards are located near highway, plants keep the air pollutants on their leaves, and heavy metals get into the soil through rainfall.

The use of areas around TEM highway changes rapidly. The areas around the roads within the borders of Tekirdag transform into industrial and residential areas rapidly.

Indirect impacts

Indirect impacts are defined as impacts on the environment which are not a direct result of the project, possibly produced some distance away from the project or as a result of a complex pathway. For this reason, indirect impacts are more difficult to measure, but are more important and dangerous. Over time, they can affect larger geographical areas. An example of an indirect impact would be the potential lowering of a water table caused by a road scheme that affects a wetland causing an impact on the ecology of that wetland. Environmental impacts should be considered not only highways rights of way, but also to sites associated with the highway project, which include deposit and borrow sites, materials treatment areas, quarries, access roads, and facilities provided for project workers. There are some indirect impacts on air, soil, water, flora, fauna, and people.

In highways in construction exhaust gases and dust particles released by heavy machines during excavations and transportations; with heavy traffic flow carbon monoxide, hydrocarbons, sulfur oxide and nitrogen oxide from vehicles process the material; cadmium and zinc coming from the friction of tires on the asphalt; and lead in gasoline, all together led to the air pollution in the area.

As the motorway intersects many roads and streams, the number of engineering works has been very high. These engineering works (bridges, rotary interchange, overbridges, crossroads etc.) changed the morphology of land. Because the research area has a plain topography, a humid and rainy climate, scarce major winds and excessive fog, the polluted air could easily be settle down on the agricultural fields.

With the effects of highway, surrounding flowing waters were polluted and water cycle was damaged. Damaging factors to the water potential in the stage of construction had been the storage of construction material in the installation sites, modification of flowing surface water in borrow areas, surface cover works and social and infrastructure needs of the staff, while intense vehicle circulation, operation of rest facilities and gas stations, increased number of car maintenance and repair shops; the use of chemicals and mineral nutrients on the road banks; increased activities of industrial establishments along the motorway were damaging waters in the stage of operation. Too many small quarries were located near to the above-mentioned rivers they borrow materials from rivers so these quarries increased the amount of particles in the rivers and caused the change their beds. For example Antalya-Alanya highway affects Duden, Aksu, Acisu Kopru Rivers and their tributaries (Mansuroglu and Kinikli 2015b). Gediz, Little Maeander and Maeander reviving the Agean Region are polluted through industrial and domestic pollution. These rivers are also indirectly affected by the destruction caused by roads. Highways are very crude instruments of economic and social change. The cultural, social, political, and economic integrity that characterizes indigenous people can be changed by highway developments. In research area with highway construction tourism and agriculture sectors developed, so the land uses and demographic character of the area has changed.

Conclusion

Highway projects can have many direct and indirect land use impacts. These impacts are often significant and should be considered when evaluating a particular policy or project. But in Turkey, the economic benefits come first in highway constructions and, in connection with this, incorrect route selections can damage the nature. Also, incorrect implementations during the

construction phase accelerate this damaging process. With the construction of Antalya-Alanya highway, agricultural fields were divided; some fertile lands were totally destroyed; erosion increased; accumulation of harmful substances in the soil accelerated; some land uses changed, population increased, and air, water and noise pollution appeared. Highways pass through many touristic areas, agricultural lands, settlements and natural areas. Determination of the impacts of the highway on the natural resources is of importance for the sustainability of the regional developments. For this reason in Antalya, Izmir and Tekirdag direct and indirect impacts of highway were considered and the problems concerned on the route choice and the uses were investigated. Direct impacts are caused by the road itself that is to say, by road building processes such as land consumption, removal of vegetation, and severance of agricultural areas. Indirect impacts are defined as impacts on the environment which are not a direct result of the project, possibly produced some distance away from the project or as a result of a complex pathway. Considering the case of Antalya, Izmir and Tekirdag highways, the measures that must be taken into consideration at the planning and implementation phases of highways in order to minimize their impacts on the environment are given below:

— An approach that takes the natural structure of the area in question into consideration and that includes the basics of ecology, sociology, urban planning and particularly landscape planning (especially in route selection) into the planning stage must be followed,
— Environmental costs and benefits must be included into the cost-benefit analyses of projects,
— Environmental Impact Assessment (EIA) procedure must be applied to highway projects,
— Factors such as topography, visual assets and ecological conditions must be evaluated together in order to provide safety, comfort and aesthetic contribution to drivers,
— Industrial and urban developments must be limited along the route,
— Expropriation area at the both sides of motorways must be kept larger in order to increase the effectiveness of plantations.

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